Jet Propulsion Laboratory
California Institute of Technology
4800 Oak Grove Drive
Pasadena, California 91109
(818) 354-4321

Airbag impact Attenuation Subsystem for the MESUR Pathfinder Mars Lander

Tommaso P. Rivellini

Jet Propulsion Laboratory
California Institute of Technology

ABSTRACT

The Mars Environmental Survey (MESUR) mission plans to send up to sixteen small, inexpensive landers to Mars to perform a long term extensive study of the Martian environment. With a budget less than half of that for the two Viking spacecraft that landed on Mars in 1975, it was clear that a radically different approach was required to achieve this mission. Before spending up to 1 billion dollars on an unproven delivery system for the MESUR Network, NASA is investing 150 million dollars on a technology Pathfinder lander to fly before the Net work mission and validate the proposed technologies.

This paper documents the initial conceptual thinking, and the subsequent proof of concept test program which CVOI ved into the current MESUR Pathfinder Mars lander. The centerpiece of the delivery system is a set of inflatable impact attenuation gas bags, (i.e. airbags) which completely surround the lander. This system allows the lander to impact the surface without having to reduce the horizontal velocity induced by the winds, The airbags are being designed to attenuate the landing impact to a maximum of 50 G's so that cheap ofr-the-shelf electronic components can be used in the lander. Lower impact G's also reduce structure mass as well as development costs for the entire lander.

This paper will also discuss the proof of concept test program which was conducted to validate, and demonstrate the design of the airbags. Mathematical performance models of the airbag were written to size and optimize the airbags. When a satisfactory design space was established, a series of subscale tests were designed to validate the mathematical models as well as to learn how to actually construct the airbags. Three series of tests were performed: vertical drops; combined vertical and horizontal velocity drops; and high altitude vacuum chamber tests.